Anaerobic biodegradation of long chain fatty acids

REFERENCE
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Experiments with oleic acid in lab scale continuous reactors evidenced that large amounts of LCFA (> 80% as palmitic) remained accumulated in the sludge and were not further converted into methane[1]. Oleic acid, which was the main LCFA in the feed, was shown to severely inhibit the mineralization of these biomass-associated LCFA. The accumulation of LCFA induced sludge flotation, which is critical in a continuous process. However, when the feed was suppressed, an efficient mineralization of the accumulated LCFA was observed, accompanied by a change in sudge colour (whitish to black) and density (from floating to settling). Further studies proven that anaerobic sludge was able to mineralize LCFA in amounts up to 5 g COD-LCFA.g VSS-1, provided it was associated to the sludge by mechanisms of adsorption, precipitation or entrapment. Furthermore, in the range of specific loads of 1-5 g COD-LCFA.g VSS-1, the anaerobic consortium showed a significant increase in the specific methanogenic activity, after the mineralization of the biomass associated LCFA[2,3]. This finding clearly contradicts the accepted theory about LCFA inhibition through mechanisms of cell membrane / wall damage, eventually inducing cytolysis and bactericidal effects. A physical transport limitation effect was proposed as the main reason for the low activity values generally reported for sludge that has been in contact with LCFA. The kinetics of mineralization of the biomass associated LCFA was established.

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